UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/336,990	06/21/1999	JIA XU	665P01US	8349

7590 09/10/2003

Mr. Jia Xu
1 Gilgorm Road
Toronto, ON M5N 2M4
CANADA

EXAMINER
TANG, KENNETH

ART UNIT	PAPER NUMBER
2127	13

DATE MAILED: 09/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/336,990	XU, JIA	
	Examiner	Art Unit	
	Kenneth Tang	2127	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 July 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *58-65,67,68,71 and 75-114* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *58-65, 67-68, 71, 75-81,83-92,94-99 and 103-114* is/are rejected.

7)☒ Claim(s) *82,86-88,90,93 and 100-102* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 June 1999* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. This non-final action is in response to paper number 10, Amendment B, filed on 7/21/03.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "method of determining whether an asynchronous process should or should not be converted into a new periodic process, by calculating whether a ratio of processing capacity of the processor which is required to be reserved for the new periodic process, to a processor capacity that is required for the asynchronous process if left unconverted, exceeds a predetermined threshold value", "a permitted range of offset of each new periodic process being is a subinterval of an interval or a full interval that begins at the earliest time that the corresponding being converted asynchronous process can make a request for execution, and ends at a time equal to the sum of the earliest time that said being converted asynchronous process can make a request for execution plus the period length of the new periodic process minus one time unit", and "comprising during run-time, detecting, in a case in which no asynchronous process or periodic process that has started is to be immediately put into execution, conditions of whether there exists an execution of some first periodic process that is ready for execution and has not completed execution, and there does not exist any other execution of some second periodic process that has not yet completed, such that execution of the second periodic process is ordered before execution of the first periodic process in the pre-run-tune schedule, and the time slot of the first periodic process is not nested within

the time slot of the second periodic process in the pre-run-time schedule, and there does not exist any other execution of some third periodic process that is ready and has not completed execution, such that execution of the third periodic process is nested within the time slot of the first periodic process in the pre- run-time schedule, and beginning execution of the first periodic process immediately in the event said conditions are true" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claims 86-88 and 90 are objected to because of the following informalities:

Spelling error: "processers" should be spelled "processors".

Appropriate correction is required.

4. Claims 93 is objected to because of the following informalities:

- "some" should be changed to "a".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 59 recites the limitation "the step of converting at least one asynchronous process" in the first two lines. There is insufficient antecedent basis for this limitation in the claim.

6. Claims 64-65, 74-75, 83-84, 91, 94-95, 99-103, 106, and 112 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "latitude" is indefinite.

7. Claims 63 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "satisfied" is indefinite.

8. Claims 62-63, 78-80, 104, and 110-111 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are:

- "exclusion relations" and "relations comprising worst-case computation time";

It is not made clear if "relations" in claims 62-63, 78-80, 104, and 110-111 refers to "exclusion relations" or "relations comprising worst-case computation time."

9. Claims 62-63, 78-80, 104, and 110-111 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "relations" is indefinite.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claim 112 is rejected under 35 U.S.C. 102(e) as being unpatentable by Dave (US 6,178,542 B1).

11. Referring to claim 112, it is rejected for the same reasons as stated in the rejection of claim 58. In addition, teaches a difference between the end time and the beginning time of each of said periodic time slots with sufficient time capacity for execution of asynchronous processes that have less latitude than considered ones of periodic processes in meeting their respective deadlines (*"For each aperiodic task, as explained before, the algorithm positions the execution slots throughout the hyperperiod after scheduling the first execution slot. If the execution slot*

cannot be allocated at the required instant, the algorithm schedules it at the earliest possible time and repositions the remaining slots to ensure that the deadlines are always met.", col. 12, lines 20-26).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claim 58 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dave (US 6,178,542 B1) in view of Dave et al. (hereinafter Dave2) (US 6,086,628).

13. Referring to claim 58, Dave teaches a method of scheduling on one or more processors, executions of a plurality of processes, comprising:

(A)

automatically generating a pre-run-time schedule comprising mapping from a set of periodic process executions to a sequence of time slots on one or more processor time axes, each of the time slots having a beginning time and an end time, reserving each one of the time slots for execution of one of the periodic processes, the positions of the end time and the beginning time of each of the time slots being such that execution of the periodic processes, including satisfaction of predetermined constraints and relations comprising worst-case computation time,

period, deadline, permitted range of offset constraints, and exclusion relations can be completed between the beginning time and end time of respective time slots *("mapping of tasks to processing elements", "finish time", "constraints", col. 1, lines 50-67, and "co-simulation", col. 2, lines 17-43, and "periodic task graphs", "deadlines", col. 4, lines 53-67, and "finish-time estimation step is enhanced by employing a deadline-based scheduling technique", col. 5, lines 1-7, "worst-case execution times", "mapping tasks", col. 5, lines 25-46, "start time", "period", "deadline", col. 5, lines 53-67, "execution time slots", col. 7, lines 40-54)*;

(B)

during run-time using the information in the pre-run-time schedule, including the positions of the beginning time and end time of the time slots of the periodic processes, to schedule the process executions *("scheduling", "tasks", "execution", "start", "finish", col. 9, lines 65-67)*.

Dave fails to explicitly teach using any offset value in a permitted range of offsets for the constraints. However, Dave2 teaches using offset values in a range of offsets for tasks to be processed *("An association array has an entry for each task of each copy of the task graph and contains information such as: 1) the PE to which it is allocated, 2) its priority level, 3) its deadline, 4) its best-case projected finish time (PFT), and 5) its worst-case PFT. The deadline of the nth instance of a task is offset by (n-1) multiplied by its period from the deadline in the original task. The association array not only eliminates the need to replicate the task graphs, but it also allows allocation of different task graph copies to different PEs, if desirable to derive an efficient architecture. This array also supports pipelining of task graphs, which is explained later in this specification.", col. 10, lines 1-12)*. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the feature of using offset values

during process synchronization for the reason of increasing the efficiency of the system ("*The association array not only eliminates the need to replicate the task graphs, but it also allows allocation of different task graph copies to different PEs, if desirable to derive an efficient architecture. This array also supports pipelining of task graphs, which is explained later in this specification.", col. 10, lines 1-12).*

14. Claims 59-65, 68, 75-76, 78-79, 81, 83-85, 89, 91, 95, 86-88, 90, 92, 94, 97-99, 103-110, 113-114 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dave (US 6,178,542 B1) in view of Dave et al. (hereinafter Dave2) (US 6,086,628, and further in view of Lindsley (US 6,430,593 B1).

15. Referring to claim 59, Dave inherently teaches mapping onto timeslots but fails to explicitly teach a method as defined in claim 58, including the step of converting at least one asynchronous process to a corresponding new periodic process prior to the mapping step, and mapping the new periodic process in a manner similar to mapping of other periodic processes. It is common knowledge in the art of task management that converting an asynchronous process to a new period process (or a synchronous process) is known as synchronization. Lindsley teaches a real-time task scheduling system which synchronizes tasks/processes *("processes", "synchronized", col. 2, lines 48-61, "asynchronous", col. 4, lines 19-23).* It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the

feature of synchronization for the reason of increasing speed and efficiency because synchronization is necessary for parallel processing.

16. Referring to claim 60, Lindsley teaches synchronization (converting asynchronous processes to a new periodic one) and Dave teaches processes comprising worst-case computation time, deadline, and minimum time between two consecutive requests constraints, will be satisfied. It is rejected for the same reasons as stated in the rejection of claim 59. In addition, Dave teaches the minimum time interval between two consecutive time instances in a time slice/slot *("minimum time interval between two consecutive instances", col. 5, lines 55-67 through col. 6, lines 1-5).*

17. Referring to claim 61, Dave teaches executing processes during real-time executions. Lindsley teaches executing a set of non-converted asynchronous processes during run-time of the processor at times which do not interfere with execution of processes contained in the pre-run-time schedule *("Interrupts perform functions on the host processor asynchronous to task execution. Since interrupts may generate events by posting semaphores, it is necessary to have a separate mechanism for issuing commands that are asynchronous to tasks.", col. 6, lines 59-67).* These executions occur during run-time and not during simulation. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the feature of executing non-converted asynchronous processes to the existing method for the reason of providing a "separate mechanism" that is "necessary."

18. Referring to claim 62, Dave in view of Lindsley teaches a method as defined in claim 58 including, following pre-run-time scheduling and during run-time of the processor, the step of scheduling executions of a specified set of periodic and asynchronous processes such that all known ones of said specified constraints and relations will be satisfied, the specified constraints and relations further comprising, for asynchronous processes, worst-case computation time, deadline, minimum time between two consecutive requests, and beginning time and end time of every time slot reserved for every periodic process execution in the pre-rum-time schedule. It is rejected for the same reasons as stated in the rejections of 59-61. In addition, Dave teaches scheduling tasks to be executed *("The next step is scheduling which determines the relative ordering of tasks/edges for execution and the start and finish times for each task and edge. The algorithm employs a combination of both preemptive and non-preemptive static scheduling.", col. 9, lines 65-67 through col. 10, lines 1-5).*

19. Referring to claim 63, Dave in view of Lindsley teaches a method as defined in claim 58 including, following pre-run-time scheduling and during rum-time of the processor, the step of scheduling executions of a specified set of periodic and asynchronous processes, worst-case computation time, deadline, minimum time between two consecutive requests, and beginning time and end time of every time slot reserved for every periodic process execution in the pre-run-time schedule *(see rejection of claim 59-62).* Dave in view of Lindsley fails to explicitly teach the specified constraints and relations will be satisfied. However, "Official Notice" is taken that both the concept and advantages of providing that satisfying all constraints/relations is well known and expected in the art. It would have been obvious to one of ordinary skill in the art at

the time the invention was made to include satisfying all constraints/relations to the existing method for the reason of improving accuracy by making sure that no constraints/relations are missed.

20. Referring to claim 64, Dave in view of Lindsley teaches *(see rejections of claim 60 and 64, for example)* scheduling, within the pre-run-time schedule, a difference between the end time and the beginning time of each of said periodic time slots with sufficient time capacity for execution of asynchronous processes that have less latitude than considered ones of periodic processes in meeting their respective deadlines. In addition, Dave teaches that processes in the schedule fit into time slots *("For each aperiodic task, as explained before, the algorithm positions the execution slots throughout the hyperperiod after scheduling the first execution slot. If the execution slot cannot be allocated at the required instant, the algorithm schedules it at the earliest possible time and repositions the remaining slots to ensure that the deadlines are always met.", col. 12, lines 20-26).*

21. Referring to claim 65, it is rejected for the same reasons as stated in the rejection of claim 64.

22. Referring to claim 75, Dave teaches a method converting a subset of a predetermined set of asynchronous processes having worst-case computation time, minimum time between two requests characteristics and deadline constraints, which have been determined to be convertible, into a set of new periodic processes having worst-case computation time, period, deadline, and

permitted range of offset constraints, and reducing possible timing conflicts with other periodic or asynchronous processes with less latitude in meeting their deadlines, by taking into consideration the computation time requirements of the latter processes when determining the deadline of the new periodic process *(see rejections of claims 58-64)*.

23. Referring to claim 76, it is rejected for the same reasons as stated in the rejection of claims 58-64. In addition, Dave teaches the process being is a full interval that begins at the earliest time that the corresponding being converted asynchronous process can make a request for execution, and ends at a time equal to the sum of the earliest time *("Each periodic task graph has an earliest start time (est), period, and deadline (do). Each task of a periodic task graph inherits the task graph's period. Each task in a periodic task graph can have a different deadline. Hard aperiodic task graphs have a specified deadline which must be met. Aperiodic task graphs are characterized by a parameter, .UPSILON., denoting the minimum time interval between two consecutive instances of an aperiodic task graph. An aperiodic task graph may start at any time.", col. 5, lines 54-67 through col. 6, lines 1-4)*. "Official Notice" is taken that both the concept and advantages of providing that making an executing request for the length of a period minus one is well known and expected in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include requesting the length of the period minus one to the existing method in order to ensure that the new process will fit in the time slot for it.

24. Referring to claim 78, Dave teaches a method as defined in claim 58, including generating the pre-run-time schedule as a feasible two-part pre-run-time-schedule for execution of periodic processes that may have non-zero offsets (a) an initial part which may be of zero length, and (b) a repeating part having length which is equal to a least common multiple of lengths of the periods of the periodic processes, all executions of all periodic processes within a time interval of length equal to the length of the least common multiple of the periodic process periods being included in the repeating part of the pre-run-time schedule, wherein all said specified constraints and relations being satisfied for all executions of all periodic processes within both said initial part and said repeating part, and using any offset value in a permitted range of offsets of each periodic process, including any offset value in the permitted range of offsets of any new periodic process that may have been converted from an asynchronous process, to generate said feasible pre-run-time schedule *("The hyperperiod of the system is computed as the least common multiple (LCM) of the periods of the various periodic task graphs in the specification. According to traditional real-time computing theory, a set of periodic task graphs has a feasible schedule if and only if it is schedulable in the hyperperiod.", col. 7, lines 33-53).* It is notoriously well known in the art of computer programming that variables can be (and most commonly are) set to zero as initial conditions and can change to non-zero values. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the feature of initializing variables because it is a standard convention/practice in the art of computer science programming. At the initial or starting state, it is common that zero items have occurred and once past the initial state, it is common that non-zero data has occurred, for example.

25. Referring to claim 79, it is rejected for the same reasons as stated in the rejection of claims 58 and 78.

26. Referring to claim 81, Dave teaches a method as defined in claim 80, including generating said pre-run-time schedule on a plurality of processors *("co-simulation", "multiple procesors", col. 2, lines 17-42).*

27. Referring to claim 83-85, 89, 91, 95, it is rejected for the same reasons as stated in the rejections of claims 58-64 and 76-79. In addition, Dave also teaches the asynchronous process is to be delayed according to the assumptions *("delay", col. 2, lines 1-15 and 47-67, and "delay constraint", col. 5, lines 25-46).*

28. Referring to claim 86, Dave teaches a carrying out the method on a plurality of processors *("co-simulation", "multiple procesors", col. 2, lines 17-42).*

29. Referring to claim 87, Dave teaches carrying out the method on a plurality of processors *("co-simulation", "multiple procesors", col. 2, lines 17-42).*

30. Referring to claim 88, Dave teaches carrying out the method on a plurality of processors *("co-simulation", "multiple procesors", col. 2, lines 17-42).*

31. Referring to claim 90, Dave teaches carrying out the method on a plurality of processors *("co-simulation", "multiple procesors", col. 2, lines 17-42).*

32. Referring to claim 92, Dave teaches carrying out the method on a plurality of processors *("co-simulation", "multiple procesors", col. 2, lines 17-42).*

33. Referring to claim 94, it is rejected for the same reasons as stated in the rejections of claim 58-64, 76, and 78.

34. Referring to claim 97, it is rejected for the same reasons as stated in the rejections of claims 58-64 and 76-79. In addition, "Official Notice" is taken that both the concept and advantages of providing that data tables is well known and expected in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include data tables to store data to the existing method for having a data structure that organizes the data for access. Dave also teaches the asynchronous process is to be delayed according to the assumptions *("delay", col. 2, lines 1-15 and 47-67, and "delay constraint", col. 5, lines 25-46).*

35. Referring to claim 98, it is rejected for the same reasons as stated in the rejections of claims 58-64. In addition, "Official Notice" is taken that both the concept and advantages of providing that data tables is well known and expected in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include data tables to store data to the existing method for having a data structure that organizes the data for access. Dave

also teaches the asynchronous process is to be delayed according to the assumptions *("delay", col. 2, lines 1-15 and 47-67, and "delay constraint", col. 5, lines 25-46)*.

36. Referring to claim 99, it is rejected for the same reasons as stated in the rejections of claims 58-64 and 76-79.

37. Referring to claim 103, it is rejected for the same reasons as stated in the rejections of claims 58-64, 76 and 78.

38. Referring to claim 104, Dave fails to explicitly teach a method as defined in claim 58, wherein said predetermined constraints and relations further comprise precedence relations. However, "Official Notice" is taken that both the concept and advantages of providing that predetermined constraints can be comprised of precedence relations is well known and expected in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the feature of having precedence relations as predetermined constraints to the existing method for the reason of using current/recent data into the system.

39. Referring to claims 105 and 107, it is rejected for the same reasons as stated in the rejections of claims 59-64.

Referring to claim 106, Dave teaches a method as defined in claim 104, including scheduling, within the pre-run-time schedule, a difference between the end time and the beginning time of

each of said periodic time slots with sufficient time capacity for execution of asynchronous processes that have less latitude than considered ones of periodic processes in meeting their respective deadlines (*"For each aperiodic task, as explained before, the algorithm positions the execution slots throughout the hyperperiod after scheduling the first execution slot. If the execution slot cannot be allocated at the required instant, the algorithm schedules it at the earliest possible time and repositions the remaining slots to ensure that the deadlines are always met.", col. 12, lines 20-26).*

40. Referring to claim 109, it is rejected for the same reasons as stated in the rejections of claims 58-64 and 76.

41. Referring to claim 110, it is rejected for the same reasons as stated in the rejections of claims 58-64 and 78.

42. Referring to claim 113, it is rejected for the same reasons as stated in the rejection of claims 59-64 and 75.

43. Claims 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dave (US 6,178,542 B1) in view of Lindsley (US 6,430,593 B1), and further in view of Matsumoto (US 5,448,732).

44. Referring to claim 77, Dave fails to explicitly teach prior to generating the pre-run-time schedule, determining whether each asynchronous process should or should not be converted into a new periodic process by a ratio or processing capacity. However, Matsumoto teaches a method of determining whether an asynchronous process should or should not be converted into a new periodic process, by calculating whether a ratio of processing capacity of the processor which is required to be reserved for the new periodic process, to a processor capacity that is required for the asynchronous *("Each of [1], [2] and [3] is a condition for improving the theoretical effectiveness, and each of [4] and [5] is a condition for doing the same by determining "n" heuristically, or from experience. Depending on the application which is running, "n" is adjusted in order to improve efficiency. With respect to conditions [4] and [5], instead of the number of processors waiting for synchronization, the ratio of the number of processors in the group to the number of processors waiting for synchronization in the group is used.", col. 6, lines 25-35)*. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the feature of synchronizing with respects to a ratio value of processing capacity for the reason of increasing the control of the system. This ratio tells the processor when it can stop waiting for synchronization to begin, for example. As mentioned earlier, it is common knowledge in the art of task management and process synchronization that converting asynchronous processes to synchronous ones is merely synchronization. In addition, Dave in view of Lindsley, and further in view of Matsumoto fail to explicitly teach using predetermined thresholds to determine a state in change. However, "Official Notice" is taken that both the concept and advantages of providing that the use of thresholds is well known and expected in the art. It would have been obvious to one of ordinary skill in the art at the time the

invention was made to include thresholds to the existing method for the reason of increasing the control by being able to set limits or boundaries which determine one state over another. In this specific case, synchronization would begin after the threshold is reached.

45. Claims 67-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dave (US 6,178,542 B1), further in view of Dave et al. (hereinafter Dave2) (US 6,086,628), further in view of Lindsley (US 6,430,593 B1), and further in view of Nilsen (US 6,438,573 B1).

46. Referring to claim 67, Dave in view of Lindsley teaches using time slicing/slots mapped into a schedule but fails to explicitly teach a method prior to the mapping step, automatically adjusting lengths of periods of a predetermined set of periodic processes, generating a set of reference periods, setting the length of the period of each periodic process to the length of the largest reference period that is no larger than an original period of the periodic process to form adjusted periods, and storing the adjusted periods for subsequent use in pre-run-time scheduling of executions of the periodic processes. However, Nilsen teaches time periods being adjusted *("an ability to adjust the periods of activity tasks", "adjust task periods so that they align more evenly with the current period of the system's real-time cyclic schedule", col. 23, lines 16-23).* The reference periods are merely used to be able to adjust the time periods and is inherently used. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the feature of adjustable lengths of time periods to the existing method for the

reason of improving synchronization of the schedule because "they align more evenly with the current period of the systems' real-time cyclic schedule."

47. Referring to claim 68, it is rejected for the same reasons as stated in the rejection of claim 67.

48. **Claims 80 and 111 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dave (US 6,178,542 B1) in view of Dave et al. (hereinafter Dave2) (US 6,086,628), and further in view of Fong et al. (hereinafter Fong) (US 6,345,287 B1).**

49. Referring to claim 80, it is rejected for the same reasons as stated in the rejection of claims 59-64, 75, and 78. Dave in view of Dave2 fails to explicitly teach scheduling with subschedules. However, Fong teaches using subpartitions and subschedules ("subpartitions", "subschedules", col. 3, lines 6-32, and col. 3, lines 55-67, and col. 4, lines 46-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the feature of subschedules/subpartitions to the existing method for the reason of increasing the flexibility of the system *("When only a mapping of applications to processors is provided by the higher level scheduler, there is additional flexibility and generality by allowing the lower level schedulers to make all or any subset of the scheduling decisions.", col. 3, lines 7-32).*

50. Referring to claim 111, it is rejected for the same reasons as stated in the rejection of claim 80.

51. **Claim 96 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dave (US 6,178,542 B1), further in view of Dave et al. (hereinafter Dave2) (US 6,086,628), and further in view of Nilsen (US 6,438,573 B1).**

52. Referring to claim 96, Dave in view of Dave2 fails to explicitly teach a method as defined in claim 58, including restricting every periodic process in the pre-run-tune schedule to be executed strictly within its time slot. However, Nilsen teaches executing within the allotted time slot and that exceeding it would be bad *("A difficulty arises, however, because the real-time executive desires to control exactly when a particular task is terminated in order to prevent one task's sin (i.e. exceeding its allotted time slot from corrupting the integrity of the entire system.", col. 9, lines 5-15)*. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the feature of not exceeding the allocated time slot for the reason of increasing the integrity of the entire system *("A difficulty arises, however, because the real-time executive desires to control exactly when a particular task is terminated in order to prevent one task's sin (i.e. exceeding its allotted time slot from corrupting the integrity of the entire system.", col. 9, lines 5-15)*.

53. Claim 71 is rejected under 35 U.S.C. 103(a) as being obvious over Matsumoto (US 5,448,732).

54. Referring to claim 71, Matsumoto teaches a method of determining whether an asynchronous process should or should not be converted into a new periodic process, by calculating whether a ratio of processing capacity of the processor which is required to be reserved for the new periodic process, to a processor capacity that is required for the asynchronous *("Each of [1], [2] and [3] is a condition for improving the theoretical effectiveness, and each of [4] and [5] is a condition for doing the same by determining "n" heuristically, or from experience. Depending on the application which is running, "n" is adjusted in order to improve efficiency. With respect to conditions [4] and [5], instead of the number of processors waiting for synchronization, the ratio of the number of processors in the group to the number of processors waiting for synchronization in the group is used.", col. 6, lines 25-35)*. As mentioned earlier, it is common knowledge in the art of task management and process synchronization that converting asynchronous processes to synchronous ones is merely synchronization. Matsumoto fails to explicitly teach using predetermined thresholds to determine a state in change. However, "Official Notice" is taken that both the concept and advantages of providing that the use of thresholds is well known and expected in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include thresholds to the existing method for the reason of increasing the control by being able to set limits or boundaries which determine one state over another.

55. **Claim 108 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dave (US 6,178,542 B1), further in view of Dave et al. (hereinafter Dave2) (US 6,086,628), further in view of Lindsley (US 6,430,593 B1), and further in view of Matsumoto (US 5,448,732).**

56. Referring to claim 108, it is rejected for the same reasons as stated in the rejections of claims 59-64 and 75.

57. Claim 114 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dave (US 6,178,542 B1), further in view of Lindsley (US 6,430,593 B1), and further in view of Matsumoto (US 5,448,732).

58. Referring to claim 114, it is rejected for the same reasons as stated in the rejection of claims 59-64, 75, and 108.

Allowable Subject Matter

59. Claim 82, 93, 100-102 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kenneth Tang whose telephone number is (703) 305-5334. The examiner can normally be reached on 9:00am-6:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William Grant can be reached on (703) 308-1108. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 746-7140.

Kt
September 7, 2003

MAJID A. BANANKHAH
PRIMARY EXAMINER